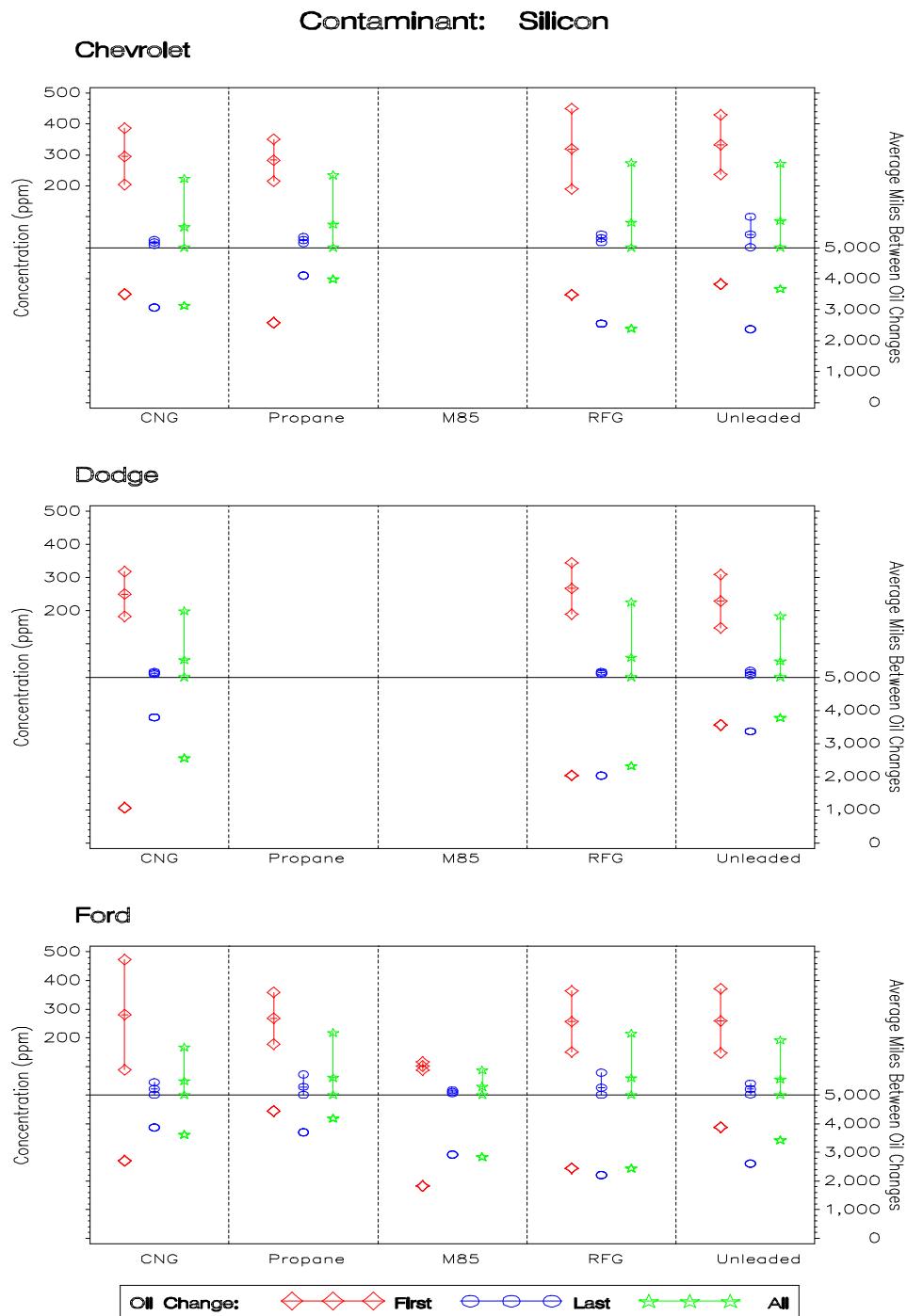


## **APPENDIX D**

### **Oil Contaminant, Additive, and Property Levels**

## VEHICLE MAINTENANCE

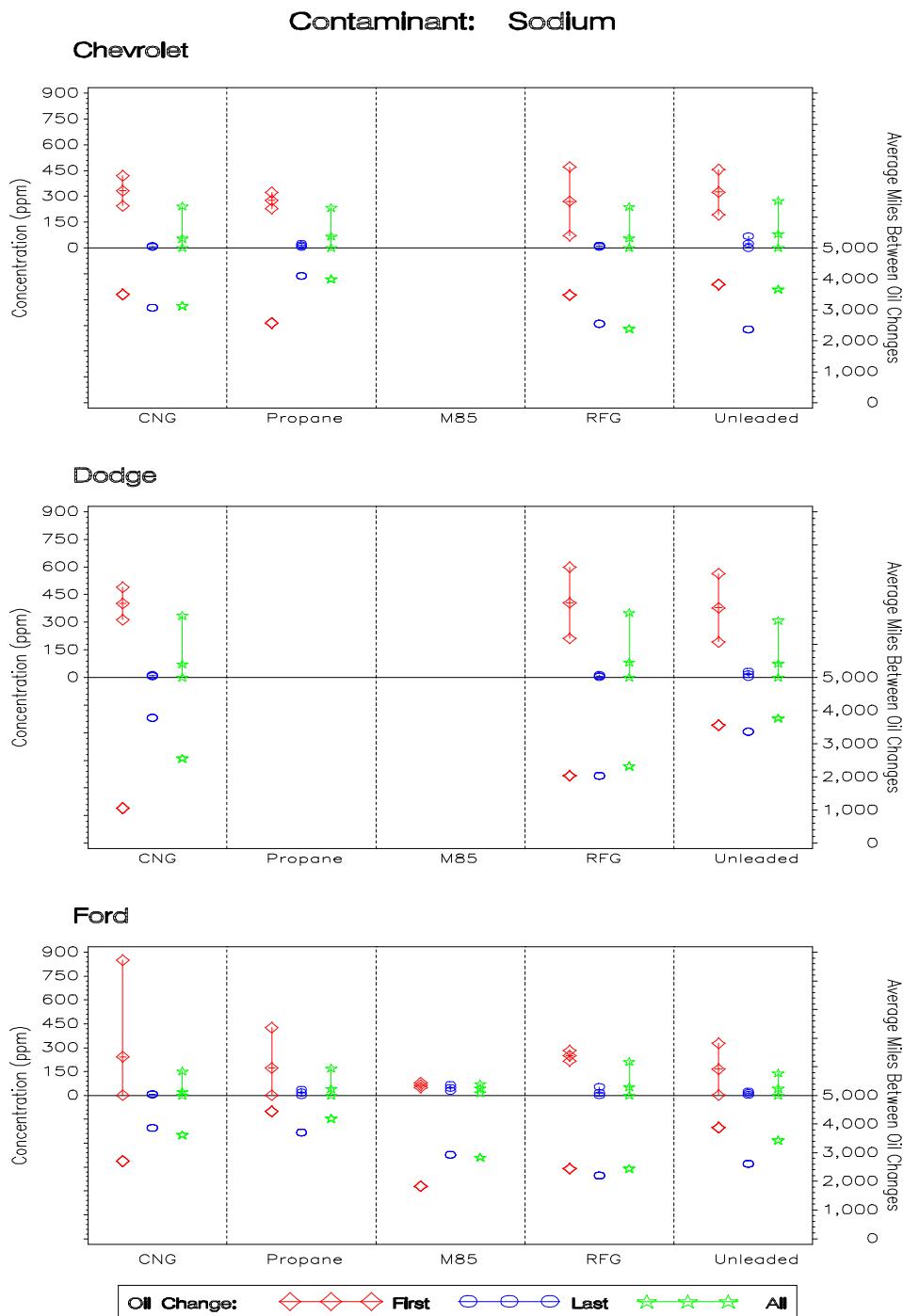
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**Figure D-1. Average Silicon Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

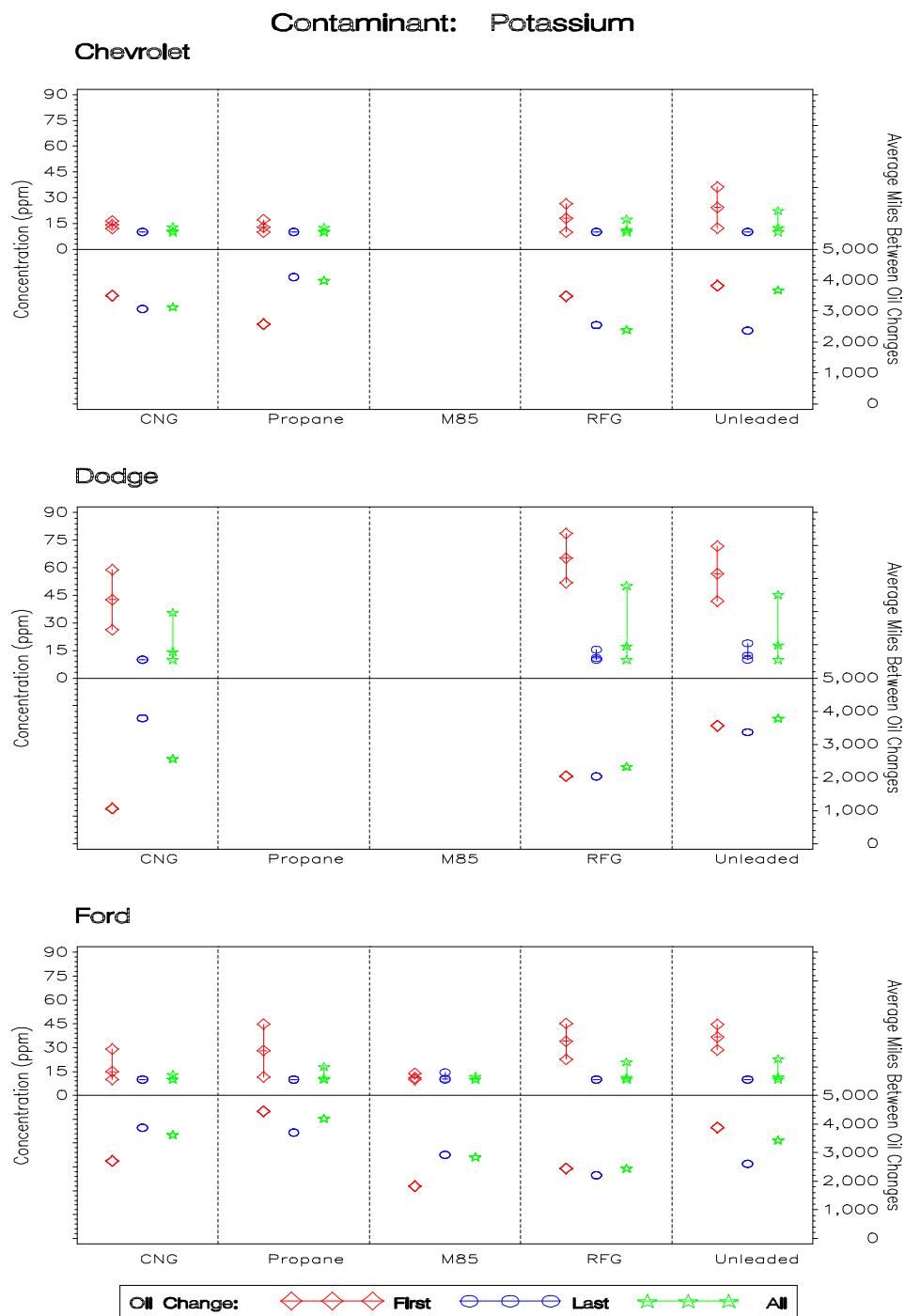
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**Figure D-2. Average Sodium Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

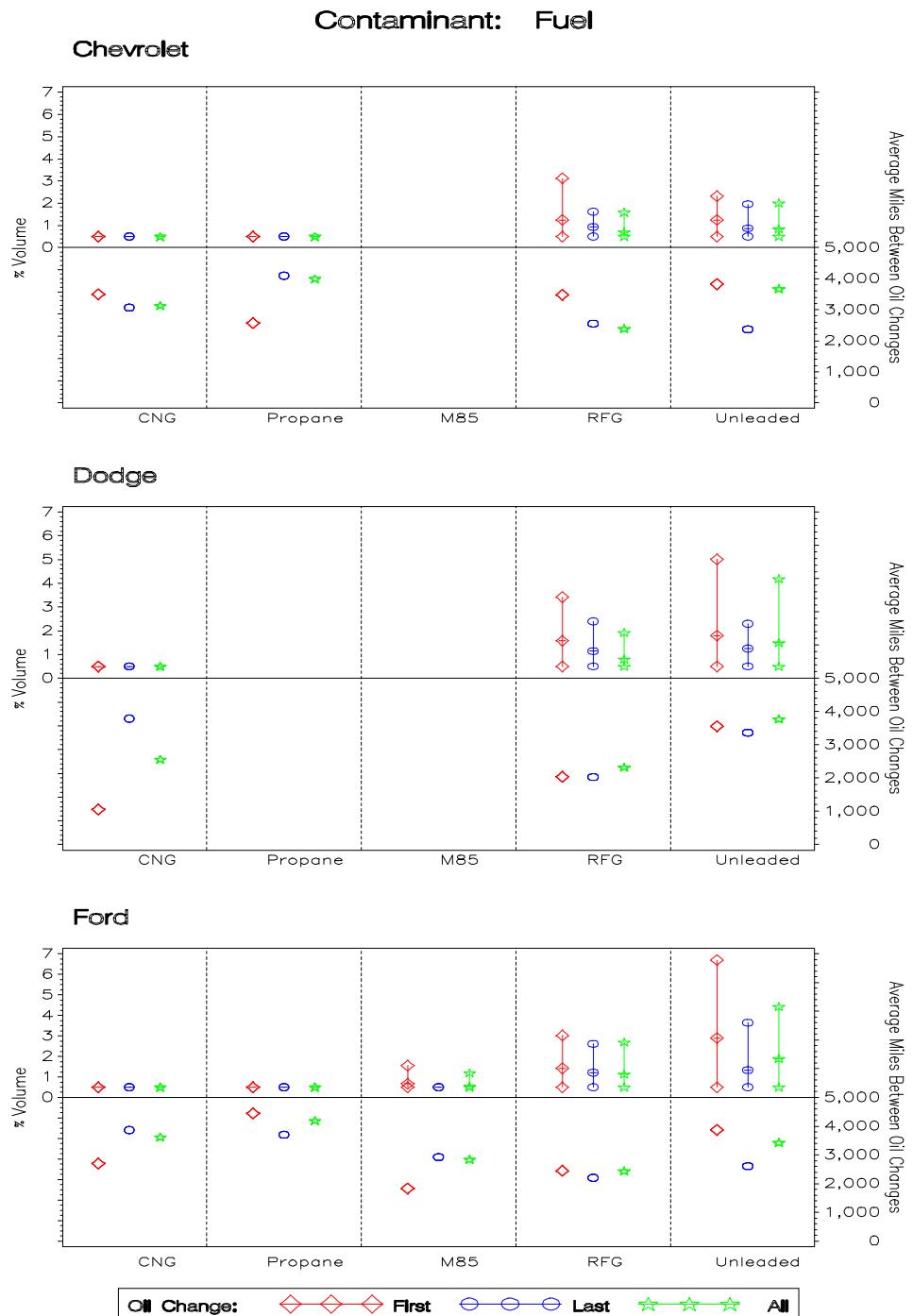
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**Figure D-3. Average Potassium Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

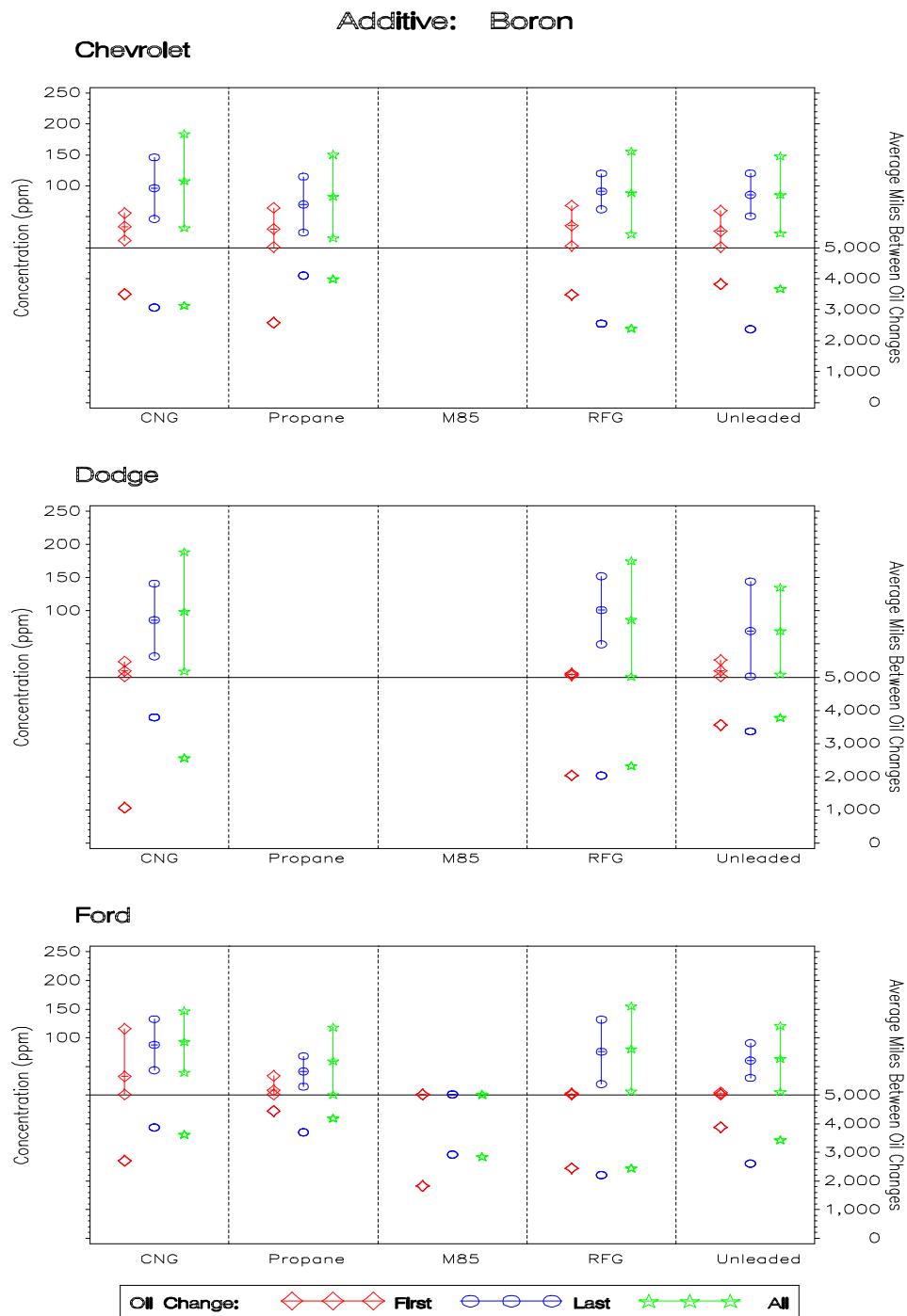
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**Figure D-4.** Average Fuel Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes

## VEHICLE MAINTENANCE

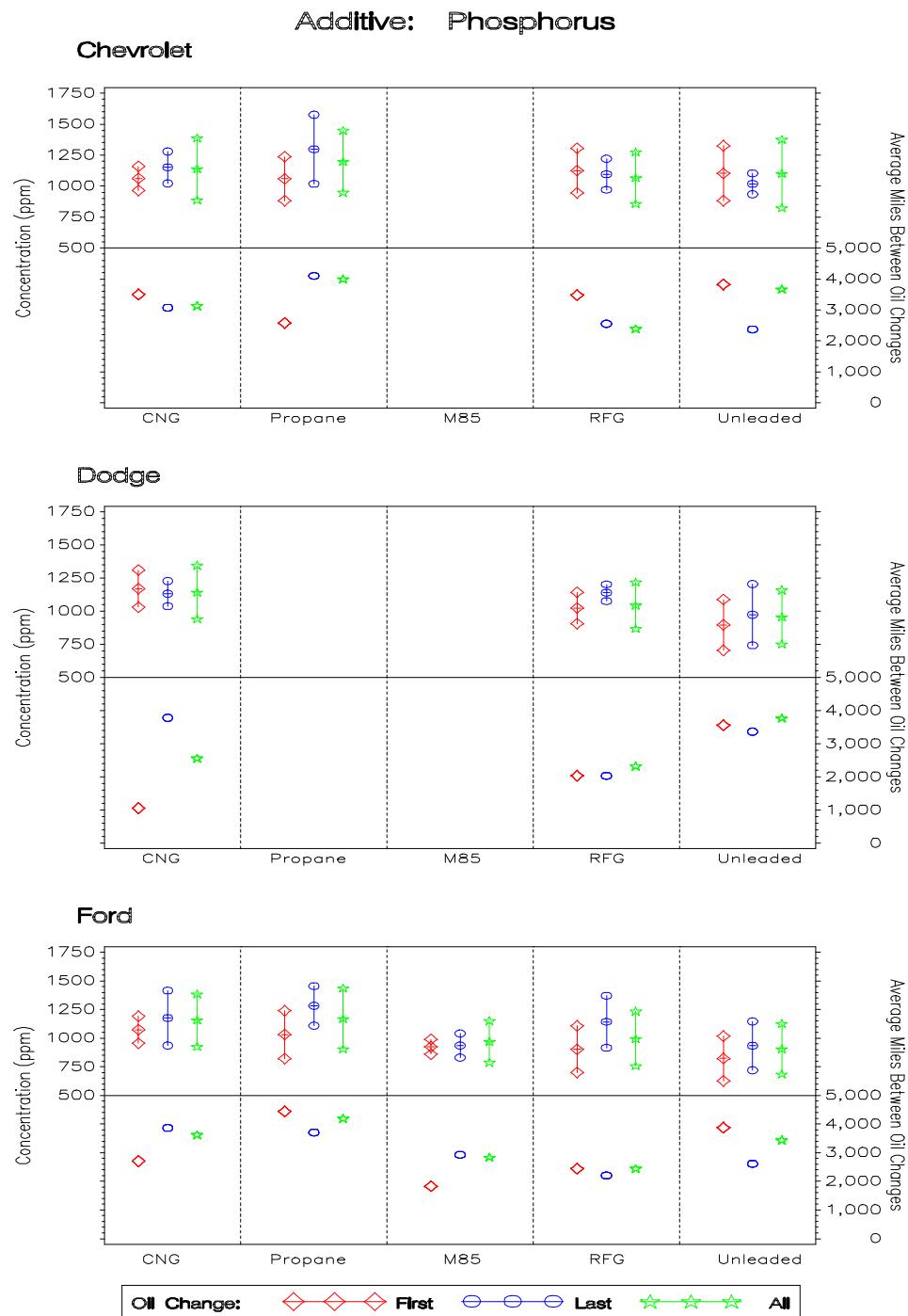
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**Figure D-5. Average Boron Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

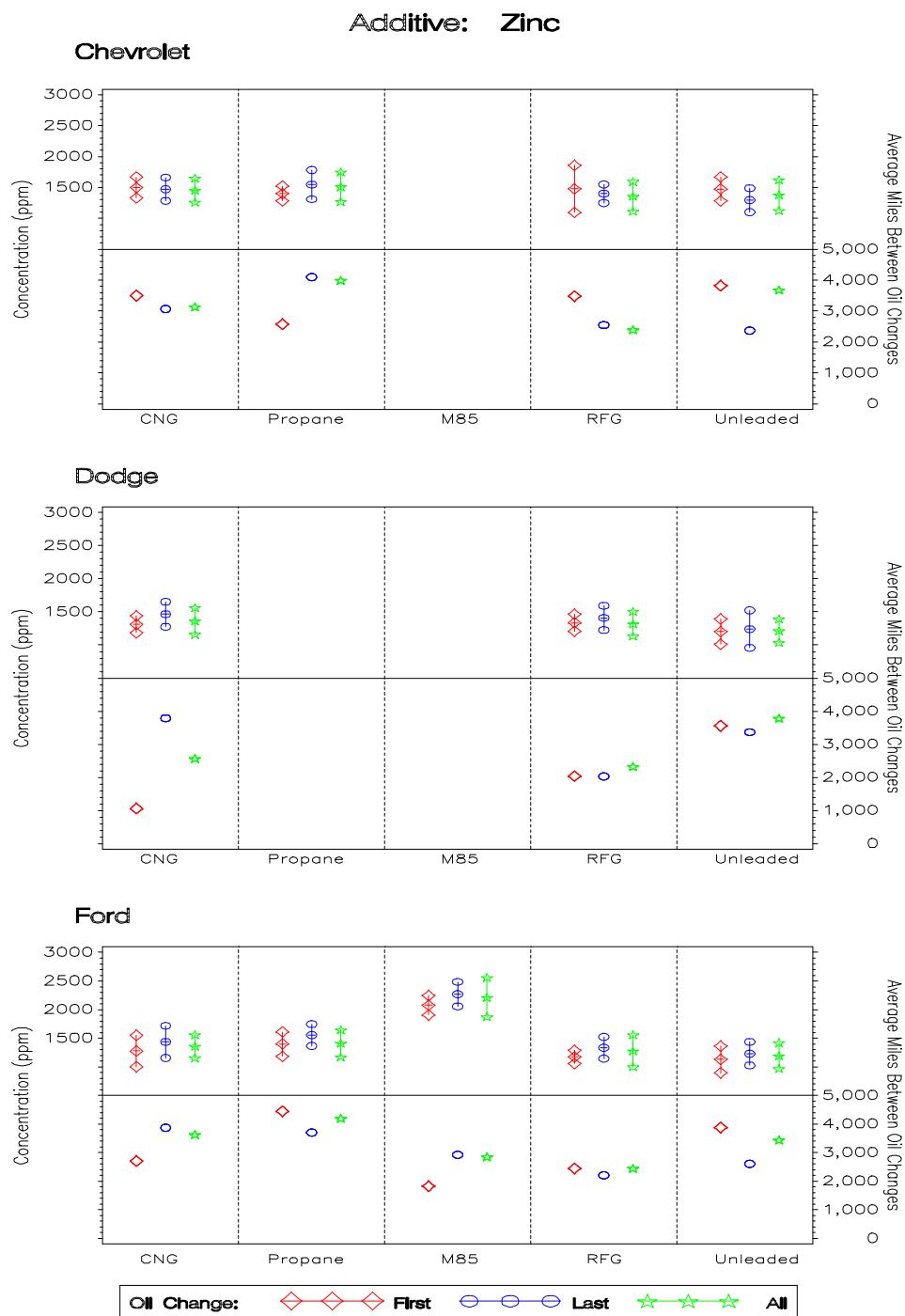
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**Figure D-6.** Average Phosphorus Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes

## VEHICLE MAINTENANCE

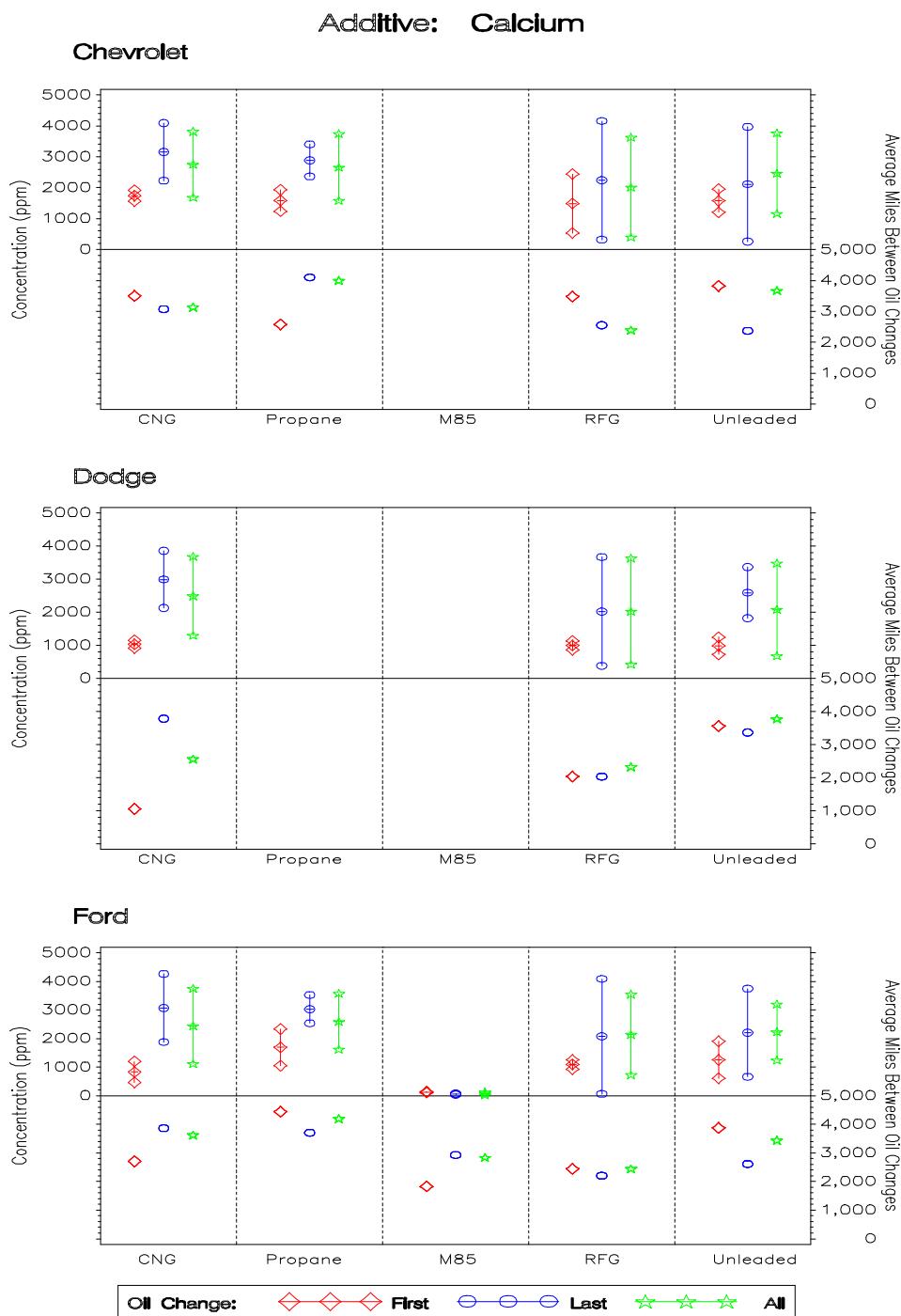
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**Figure D-7. Average Zinc Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

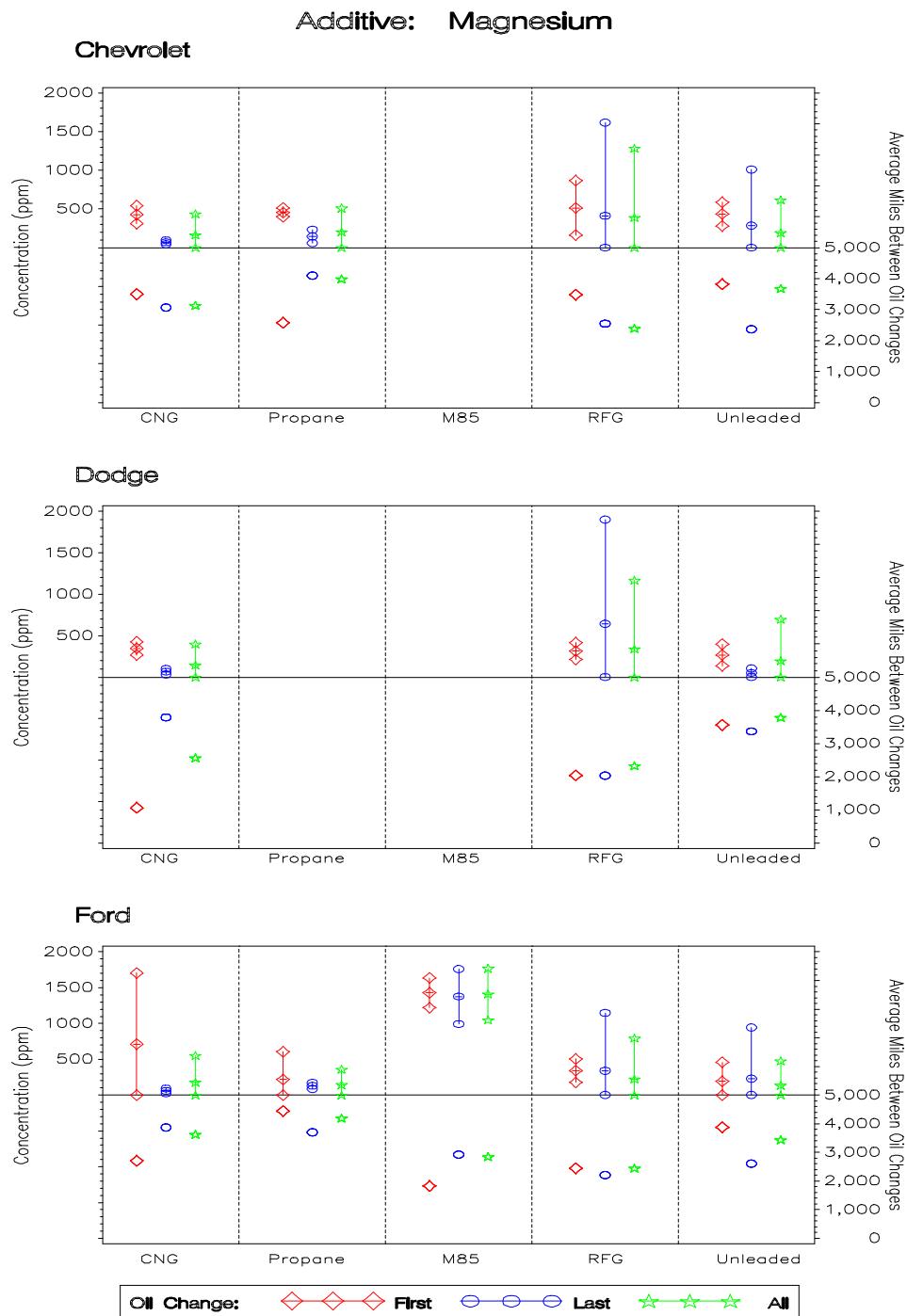
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**Figure D-8. Average Calcium Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

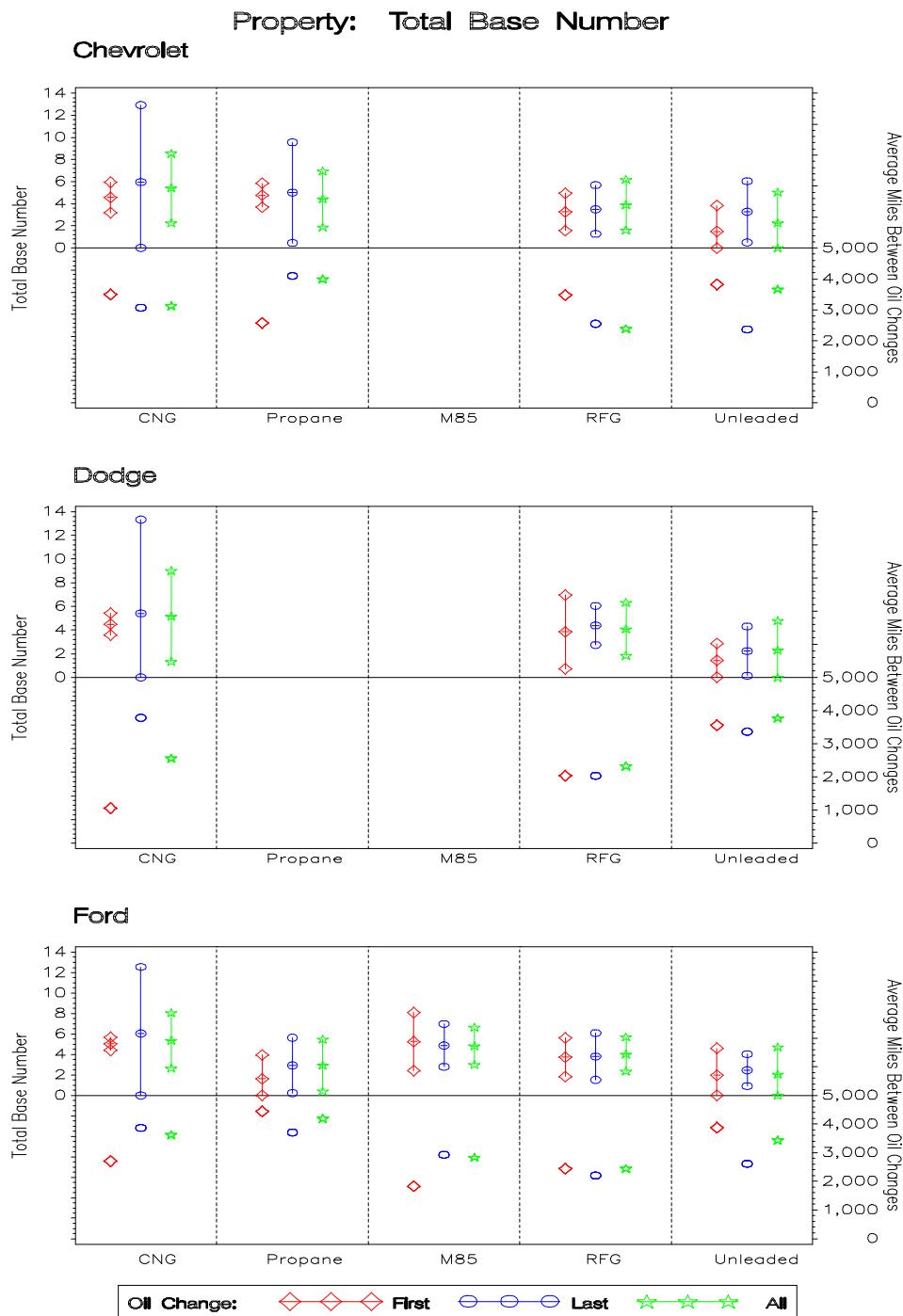
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**Figure D-9. Average Magnesium Concentration in Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

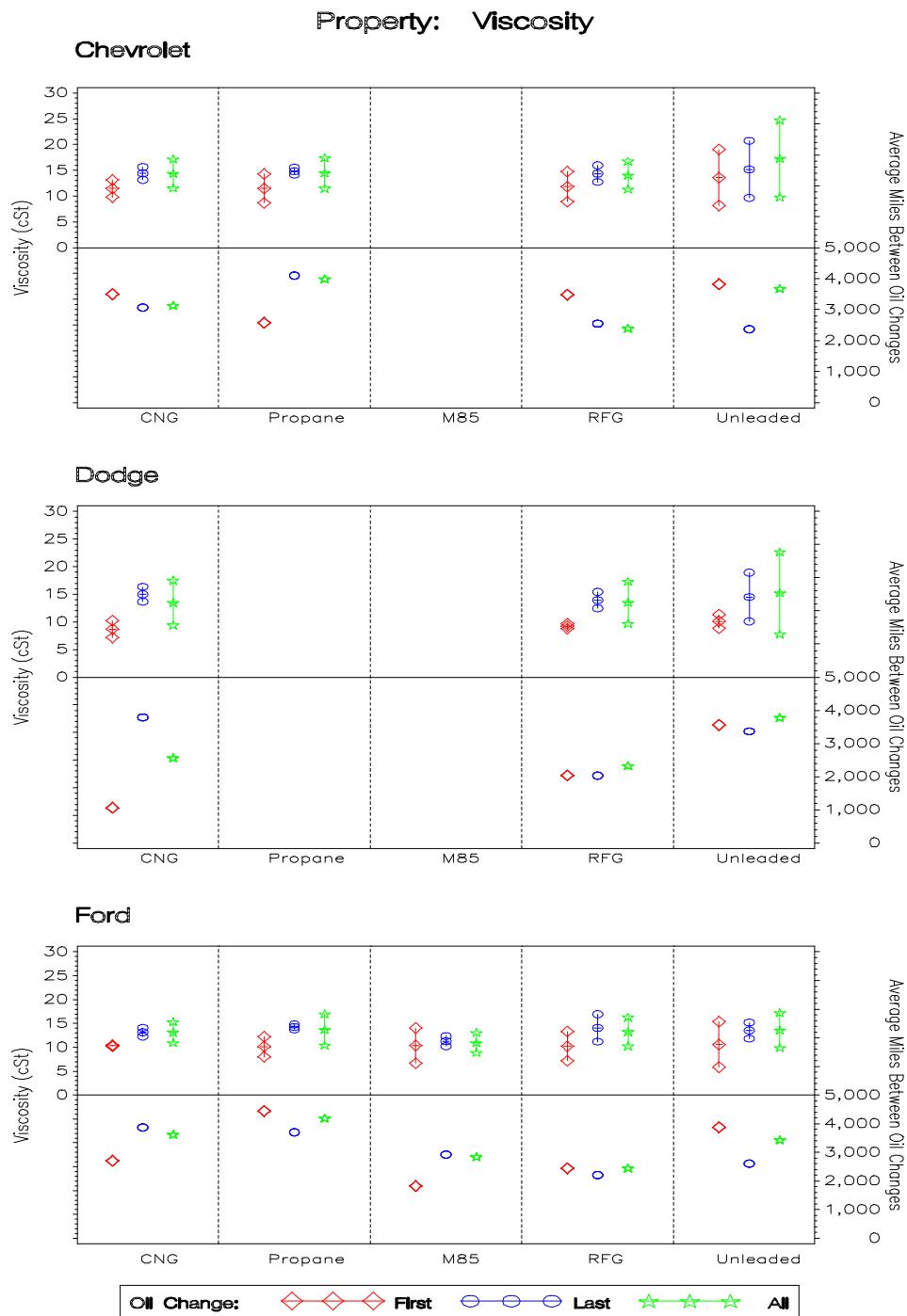
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**Figure D-10. Average Total Base Number of Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

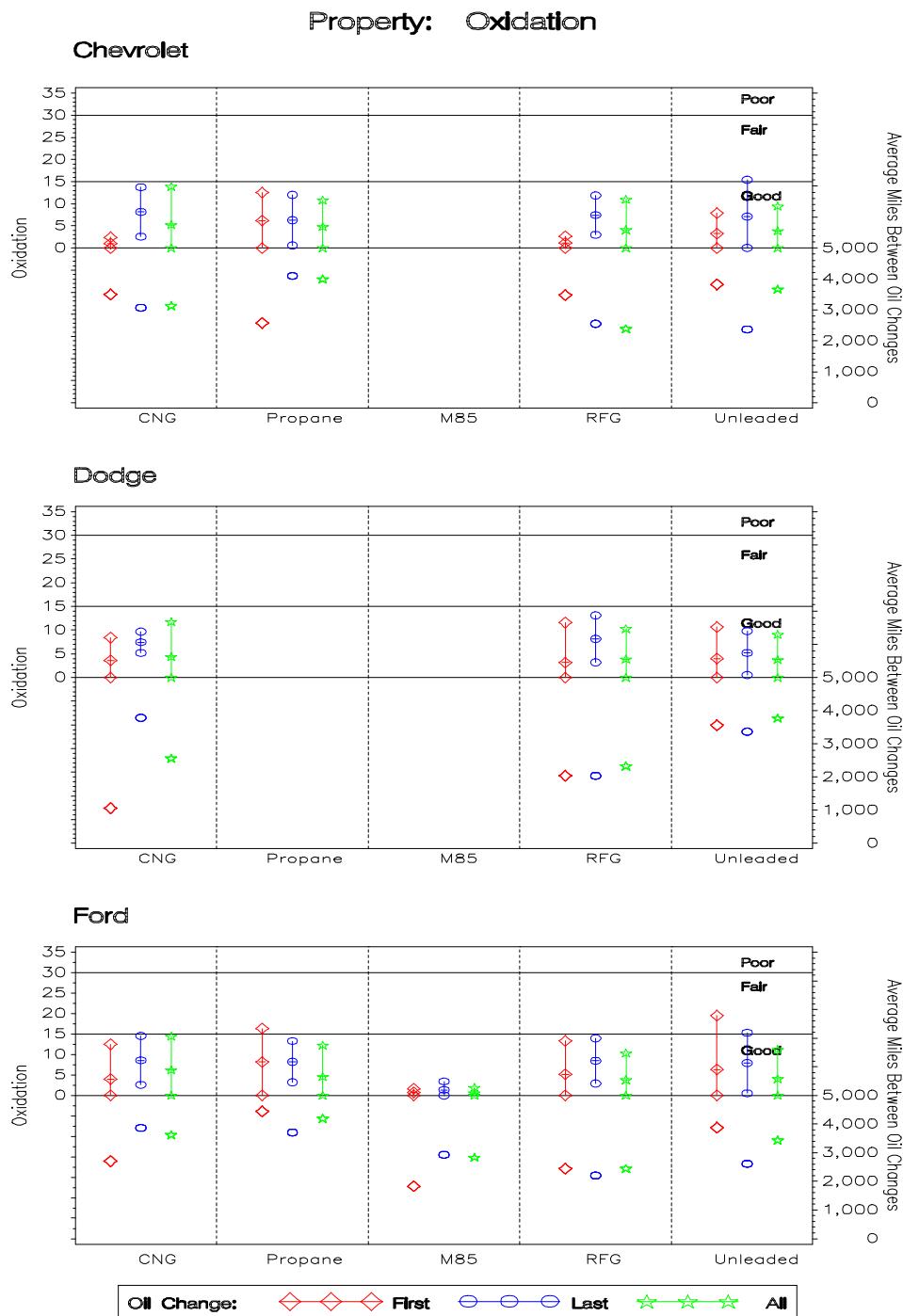
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**Figure D-11. Average Viscosity of Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

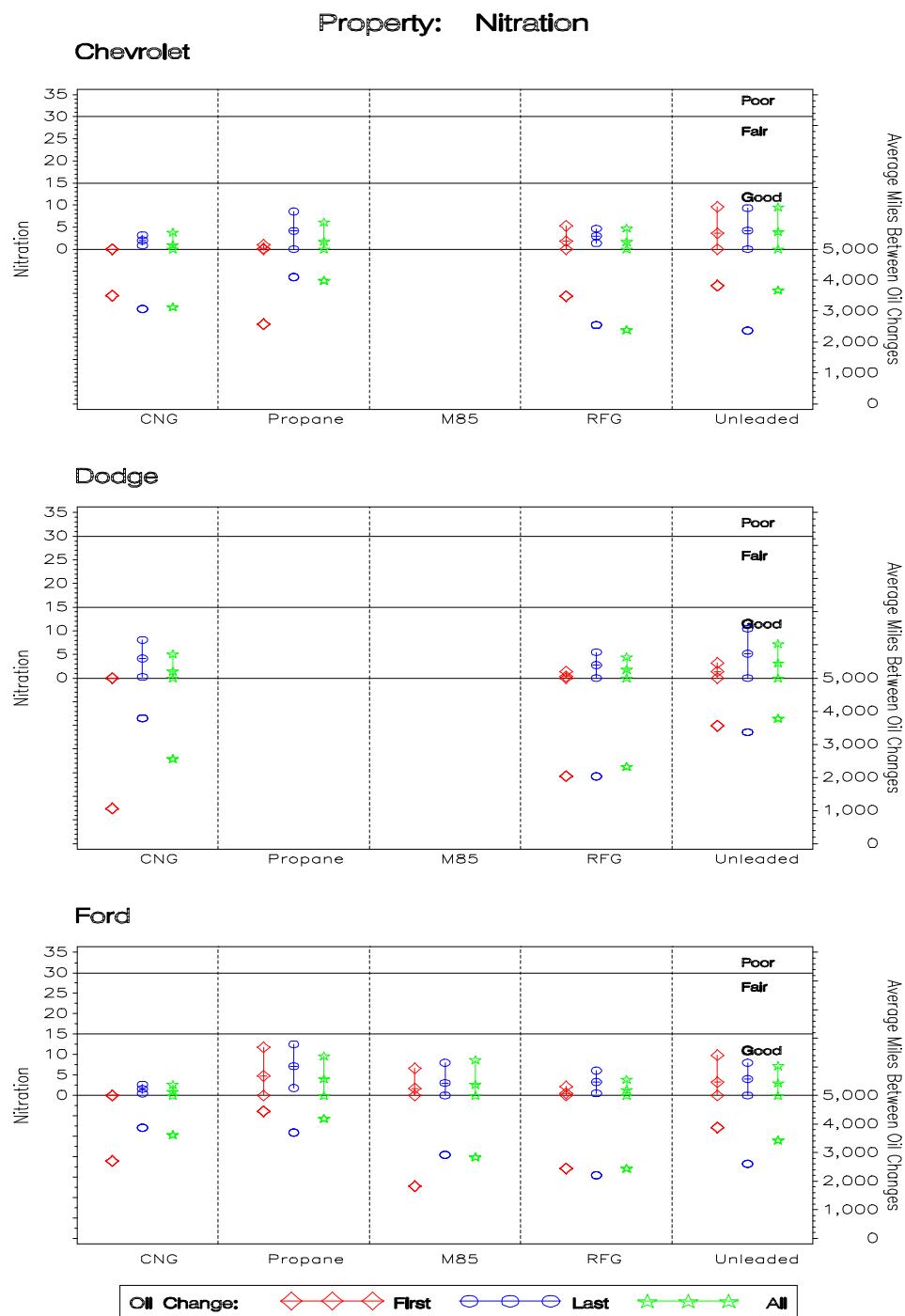
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**Figure D-12. Average Oxidation of Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes**

## VEHICLE MAINTENANCE

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**Figure D-13.** Average Nitration of Used Oil, with 95% Prediction Bounds, at First and Last Oil Changes and for All Oil Changes

## VEHICLE MAINTENANCE

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**Table D-1. Average and Standard Deviation (SD) of Measured Oil Properties at the First and Last Oil Changes and for All Oil Changes**

Location	Vehicle Manufacturer	Fuel	Oil Change	Number of Oil Changes	Avg. Oil Miles <sup>(a)</sup>	Number of Oil Analyses	Silicon Avg. (SD)	Sodium Avg. (SD)	Potassium Avg. (SD)	Fuel (%vol) Avg. (SD)
Chevron DELO 15W40 base oil <sup>(b)</sup>							2.0( 1.4)	27.5( 6.4)	10.0( - ) <sup>(f)</sup>	- ( - ) <sup>(c)</sup>
Lubrizol MEV 10W30 base oil <sup>(d)</sup>							10.5( 2.1)	9.0( 1.4)	10.0( - )	0.1( - )
Irvine	CHEVY	CNG	First	7	3495	5	295.0( 45.6)	332.6( 43.7)	14.2( 1.1)	0.5(0.0)
			Last	7	3068	7	16.7( 4.1)	9.0( 1.2)	10.0( 0.0)	0.5(0.0)
			All	58	3134	54	67.4( 78.5)	56.3( 93.3)	10.4( 1.3)	0.5(0.0)
		UNL	First	3	4113	3	333.7( 29.7)	287.7( 23.1)	27.7( 4.0)	1.3(0.3)
			Last	3	2421	3	35.3( 11.8)	16.3( 3.5)	10.0( 0.0)	1.1(0.8)
			All	27	4475	25	85.8( 97.4)	79.0( 88.7)	14.3( 6.4)	0.9(0.6)
	DODGE	CNG	First	7	1059	5	250.8( 33.9)	401.6( 44.3)	42.6( 8.1)	0.5(0.0)
			Last	7	3786	7	12.4( 1.7)	9.7( 1.8)	10.0( 0.0)	0.5(0.0)
			All	59	2566	52	52.2( 74.1)	74.4(131.3)	14.4(10.6)	0.5(0.0)
		UNL	First	3	3610	2	255.5( 4.9)	442.5( 3.5)	54.0( 9.9)	0.8(0.4)
			Last	3	4527	3	12.7( 5.0)	21.7( 8.1)	14.3( 3.8)	1.3(0.3)
	FORD	CNG	First	7	2704	2	281.0( 96.2)	242.0(304.1)	15.0( 7.1)	0.5( - )
			Last	7	3866	7	21.7( 11.4)	6.9( 0.7)	10.0( 0.0)	0.5(0.0)
			All	57	3627	49	50.1( 58.7)	23.7( 64.8)	10.2( 1.4)	0.5(0.0)
		UNL	First <sup>(e)</sup>	3	-	0	- ( - )	- ( - )	- ( - )	- ( - )
			Last	3	2644	3	17.0( 2.6)	14.3( 2.3)	10.0( 0.0)	0.8(0.3)
			All	27	4197	24	34.0( 20.2)	34.3( 28.2)	10.4( 1.2)	1.5(1.1)
Rialto	CHEVY	PRO	First	7	2572	6	282.5( 33.8)	276.0( 23.4)	12.8( 2.1)	0.5(0.0)
			Last	7	4097	7	24.7( 4.9)	15.3( 4.2)	10.0( 0.0)	0.5(0.0)
		UNL	First	3	4096	3	318.7( 70.5)	305.3( 47.9)	19.5( 2.1)	0.8(0.6)
			Last	3	3170	3	68.0( 39.0)	49.3( 22.8)	10.0( 0.0)	0.5(0.0)
	FORD	PRO	All	27	4209	27	96.7( 88.4)	98.3( 84.7)	11.6( 2.7)	0.6(0.4)
			First	13	4445	13	267.9( 45.2)	172.5(126.8)	28.3( 8.3)	0.5(0.0)
			Last	13	3703	13	28.8( 21.4)	17.5( 9.3)	10.0( 0.0)	0.5(0.0)
			All	118	4195	117	61.5( 78.4)	43.3( 64.3)	10.7( 3.7)	0.5(0.0)
	UNL	First	3	6317	3	303.7( 49.8)	58.0( 2.0)	38.5( 3.5)	1.2(1.2)	
		Last	3	3299	3	34.7( 9.6)	21.3( 2.3)	10.0( 0.0)	0.7(0.3)	
		All	27	4586	27	74.4( 85.4)	37.3( 15.8)	12.7( 7.7)	1.3(0.8)	

## VEHICLE MAINTENANCE

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**Table D-1. Average and Standard Deviation (SD) of Measured Oil Properties at the First and Last Oil Changes and for All Oil Changes (Continued)**

Location	Vehicle Manufacturer	Fuel	Oil Change	Number of Oil Changes	Avg. Oil Miles <sup>(a)</sup>	Number of Oil Analyses	Silicon Avg. (SD)	Sodium Avg. (SD)	Potassium Avg. (SD)	Fuel (%vol) Avg. (SD)
Los Angeles	CHEVY	RFG	First	7	3478	6	319.3( 64.9)	271.3(100.0)	18.0( 4.2)	1.3(0.9)
			Last	7	2548	7	30.1( 6.3)	10.1( 1.8)	10.0( 0.0)	0.9(0.3)
			All	55	2392	48	82.2(95.9)	58.0(91.6)	11.3( 3.0)	0.7(0.4)
	DODGE	UNL	First	3	2976	2	352.5( 55.9)	409.5( 70.0)	24.0( 9.9)	1.8(0.4)
			Last	3	1511	3	24.7( 8.1)	10.3( 1.5)	10.0( 0.0)	1.0(0.5)
			All	23	2041	21	76.2( 95.9)	69.7(119.1)	11.6( 4.8)	1.0(0.7)
	FORD	RFG	First	7	2039	6	267.5( 38.7)	405.2( 96.8)	65.3( 6.7)	1.6(0.9)
			Last	7	2030	7	13.0( 1.7)	7.9( 2.3)	10.9( 2.3)	1.1(0.6)
			All	55	2330	48	60.0( 83.1)	83.4(134.7)	17.4(16.4)	0.8(0.6)
	FORD	UNL	First	3	3522	3	212.0( 45.7)	335.0(101.5)	59.5( 6.4)	2.5(1.8)
			Last	3	2202	3	13.0( 1.0)	13.3( 2.5)	10.0( 0.0)	1.2(0.8)
			All	25	3172	22	51.4( 68.9)	75.7(115.0)	15.9(14.9)	1.4(1.0)
Santa Ana	FORD	M85	First	7	2446	6	257.0( 53.4)	249.3( 16.5)	34.0( 5.7)	1.4(0.8)
			Last	7	2205	7	25.9( 26.1)	15.4( 19.2)	10.0( 0.0)	1.2(0.7)
	FORD	UNL	All	57	2448	51	60.6( 77.4)	53.3( 80.1)	11.2( 5.0)	1.1(0.8)
			First	3	1994	3	257.0( 66.1)	224.7( 24.8)	33.0( - )	3.5(2.3)
			Last	3	1970	3	14.3( 0.6)	10.3( 1.5)	10.0( 0.0)	2.5(2.0)
			All	26	2198	24	61.3( 80.9)	52.8( 70.3)	12.7( 8.2)	2.4(1.4)
ALL	CHEVY	UNL	First	20	1829	20	101.5( 7.1)	64.3( 7.6)	11.1( 1.4)	0.7(0.4)
			Last	20	2925	20	11.3( 2.6)	47.2( 9.1)	10.5( 2.0)	0.5(0.0)
	DODGE	UNL	All	164	2845	162	30.1( 29.0)	44.1( 13.8)	10.2( 0.9)	0.5(0.3)
			First	3	3307	3	217.3( 7.0)	210.3( 14.7)	- ( - )	4.0(1.0)
			Last	3	2527	3	17.0( 2.6)	10.3( 1.5)	10.0( 0.0)	1.3(0.3)
			All	27	2717	27	52.4( 62.3)	52.6( 60.7)	10.3( 0.8)	2.4(1.4)
	FORD	UNL	First	6	3557	5	229.4( 40.2)	378.0( 92.8)	56.8( 7.5)	1.8(1.6)
			Last	6	3364	6	12.8( 3.3)	17.5( 7.0)	12.2( 3.4)	1.3(0.5)
			All	52	3780	45	49.0( 68.0)	77.6(116.4)	18.0(13.7)	1.5(1.3)

(a) Average miles between oil changes.  
 (b) Used in all vehicles except Ford M-85.

(c) No results were obtained.  
 (d) Used only in Ford M-85 vehicles.

(e) Oil samples were not collected.  
 (f) Fewer than two results were obtained.

## VEHICLE MAINTENANCE

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**Table D-2. Average and Standard Deviation (SD) of Measured Oil Properties at the First and Last Oil Changes and for All Oil Changes**

Location	Vehicle Manufacturer	Fuel	Oil Change	Number of Oil Changes	Avg. Oil Miles <sup>(b)</sup>	Number of Oil Analyses	Boron Avg. (SD)	Phosphorus Avg. (SD)	Zinc Avg. (SD)	Calcium Avg. (SD)	Magnesium Avg. (SD)
	Chevron DELO 15W40 base oil <sup>(b)</sup>						166.0( 1.4)	1055( 6)	1236( 37)	2315( 35)	57( 38)
	Lubrizol MEV 10W30 base oil <sup>(c)</sup>						4.5( 2.1)	1118(110)	2200(127)	43( 18)	2462(776)
Irvine	CHEVY	CNG	First	7	3495	5	33.8(11.1)	1062( 49)	1499( 84)	1743( 88)	426( 58)
			Last	7	3068	7	96.1(24.9)	1151( 65)	1471( 94)	3159(466)	70( 13)
	UNL		All	58	3134	54	107.9(38.0)	1139(125)	1451( 97)	2751(533)	164(137)
			First	3	4113	3	22.7(16.3)	1167( 37)	1471( 69)	1661(120)	486( 56)
	DODGE	CNG	Last	3	2421	3	94.7(15.5)	984( 55)	1240( 57)	2497(99)	50( 25)
			All	27	4475	25	82.1(31.4)	1131(111)	1374(115)	2626(460)	136(140)
	FORD	CNG	First	7	1059	5	9.2( 7.2)	1170( 70)	1312( 64)	1032( 60)	346( 40)
			Last	7	3786	7	86.1(27.4)	1132( 47)	1463( 94)	2988(433)	67( 17)
Rialto	CHEVY	UNL	All	59	2566	52	99.3(45.0)	1143(101)	1360(101)	2491(597)	143(127)
			First	3	3610	2	5.0( 1.4)	969( 52)	1263( 78)	998( 37)	305( 18)
	FORD	UNL	Last	3	4527	3	46.3(31.9)	910(110)	1172(134)	2367(106)	30( 6)
			All	27	4362	23	70.2(31.3)	981( 95)	1221( 74)	2250(458)	124( 93)
	CHEVY	PRO	First	7	2704	2	32.5(41.7)	1074( 59)	1276(139)	830(184)	710(498)
			Last	7	3866	7	87.9(22.3)	1175(120)	1436(140)	3065(595)	58( 17)
	FORD	PRO	All	57	3627	49	93.3(26.8)	1157(114)	1357(101)	2438(658)	178(187)
			First <sup>(d)</sup>	3	-	0	- ( - )	- ( - )	- ( - )	- ( - )	- ( - )
	CHEVY	UNL	Last	3	2644	3	68.0(18.4)	928( 50)	1230( 59)	2546(206)	53( 17)
			All	27	4197	24	61.8(17.4)	925( 91)	1224( 89)	2391(260)	135(129)
	FORD	UNL	First	13	4445	13	8.5(12.5)	1031(105)	1398(107)	1690(321)	218(194)
			Last	13	3703	13	41.2(13.4)	1281( 86)	1555( 96)	3025(247)	130( 21)
			All	118	4195	117	59.2(29.8)	1171(133)	1410(118)	2599(487)	144(107)
			First	3	6317	3	3.7( 0.6)	927( 92)	1265( 55)	1668(129)	26( 14)
			Last	3	3299	3	49.3( 3.5)	954(114)	1264(170)	2459(284)	117( 29)
			All	27	4586	27	50.7(19.5)	970(103)	1228(142)	2340(347)	94( 48)

## VEHICLE MAINTENANCE

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**Table D-2. Average and Standard Deviation (SD) of Measured Oil Properties at the First and Last Oil Changes and for All Oil Changes (Continued)**

Location	Vehicle Manufacturer	Fuel	Oil Change	Number of Oil Changes	Avg. Oil Miles <sup>(a)</sup>	Number of Oil Analyses	Boron Avg. (SD)	Phosphorus Avg. (SD)	Zinc Avg. (SD)	Calcium Avg. (SD)	Magnesium Avg. (SD)
Los Angeles	CHEVY	RFG	First	7	3478	6	35.5(16.4)	1125( 90)	1476(190)	1487(477)	515(176)
			Last	7	2548	7	90.9(14.5)	1096( 63)	1397( 75)	2238(959)	412(602)
			All	55	2392	48	88.9(33.5)	1067(105)	1354(121)	2018(808)	392(447)
		UNL	First	3	2976	2	22.5(26.2)	985(128)	1367( 74)	1360(236)	430(71)
			Last	3	1511	3	85.7(14.2)	1050( 5)	1327( 30)	1475(2E3)	647(461)
		DODGE	All	23	2041	21	94.2(31.7)	987(136)	1285( 86)	2140(788)	265(322)
			First	7	2039	6	4.2( 0.8)	1024( 59)	1336( 65)	996( 67)	316( 51)
			Last	7	2030	7	100.9(25.6)	1138( 32)	1408( 92)	2020(821)	643(629)
			All	55	2330	48	86.7(44.4)	1045( 87)	1320( 93)	2030(801)	342(413)
FORD	RFG	RFG	First	7	2446	6	1.5( 0.8)	903(102)	1173( 58)	1093( 81)	341( 81)
			Last	7	2205	7	75.6(28.2)	1142(113)	1333( 94)	2075(1E3)	340(404)
			All	57	2448	51	80.9(37.2)	996(119)	1279(140)	2139(705)	223(286)
			First	3	1994	3	1.3( 0.6)	793( 60)	1056( 96)	1075(143)	300(72)
		UNL	Last	3	1970	3	61.7(13.3)	1036( 74)	1247( 63)	1257(1E3)	694(513)
			All	26	2198	24	70.8(35.0)	893(109)	1154(105)	1944(692)	233(300)
Santa Ana	FORD	M85	First	20	1829	20	1.0( 0.0)	925( 32)	2076( 85)	128( 8)	1429(104)
			Last	20	2925	20	1.1( 0.2)	935( 53)	2270(107)	57( 9)	1377(192)
			All	164	2845	162	1.0( 0.2)	969( 91)	2214(172)	77( 24)	1409(180)
			First	3	3307	3	1.3( 0.6)	747( 6)	1067( 25)	1027( 23)	257( 15)
		UNL	Last	3	2527	3	62.3(21.4)	811( 42)	1179(125)	2550( 98)	56( 6)
			All	27	2717	27	72.1(34.0)	840( 97)	1159( 89)	2219(460)	92( 64)
ALL	CHEVY	UNL	First	9	3822	8	26.8(16.5)	1103(111)	1474( 96)	1580(189)	434( 77)
			Last	9	2368	9	85.2(17.3)	1018( 42)	1294( 96)	2112(926)	284(363)
	DODGE	UNL	First	6	3557	5	9.6( 8.1)	897( 96)	1201( 95)	984(131)	267( 65)
			Last	6	3364	6	69.5(37.4)	973(116)	1239(141)	2588(386)	51( 28)
	FORD	UNL	All	52	3780	45	70.1(32.7)	955(102)	1213( 89)	2078(699)	199(250)
			First	12	3873	9	2.1( 1.3)	822( 98)	1129(117)	1256(324)	194(133)
			Last	12	2610	12	60.3(15.1)	932(106)	1230(103)	2203(771)	230(357)
			All	107	3438	102	63.7(28.7)	907(110)	1192(113)	2227(489)	136(171)

(a) Average miles between oil changes.

(b) Used in all vehicles except Ford M-85.

(c) Used only in Ford M-85 vehicles.

(d) Oil samples were not collected.

## VEHICLE MAINTENANCE

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**Table D-3. Average and Standard Deviation (SD) of Measured Oil Properties at the First and Last Oil Changes and for All Oil Changes**

Location	Vehicle Manufacturer	Fuel	Oil Change	Number of Oil Changes	Avg. Oil Miles <sup>(a)</sup>	Number of Oil Analyses	Viscosity Avg. (SD)	TBN Avg. (SD)	Oxidation Avg. (SD)	Nitration Avg. (SD)
Chevron DELO 15W40 base oil <sup>(b)</sup>							15.1(0.7)	6.5(1.4)	- (-) <sup>(c)</sup>	- (-) <sup>(c)</sup>
Lubrizol MFV 10W30 base oil <sup>(d)</sup>							10.9(0.6)	8.5(0.7)	- (-) <sup>(c)</sup>	- (-) <sup>(c)</sup>
Irvine	CHEVY	CNG	First	7	3495	5	11.5(0.8)	4.6(0.7)	1.0(0.7)	0.0(0.0)
			Last	7	3068	7	14.4(0.6)	6.0(3.5)	8.1(2.8)	2.0(0.6)
	UNL		All	58	3134	54	14.4(1.4)	5.4(1.6)	5.2(4.3)	1.0(1.5)
			First	3	4113	3	13.4(1.5)	0.4(0.6)	4.3(2.5)	3.0(1.0)
	DODGE	CNG	Last	3	2421	3	14.6(0.6)	2.3(2.0)	3.0(2.6)	3.7(2.1)
			All	27	4475	25	18.3(3.8)	1.8(1.4)	3.4(2.4)	3.9(2.4)
	FORD	CNG	First	7	1059	5	8.7(0.8)	4.5(0.5)	3.6(2.4)	0.0(0.0)
			Last	7	3786	7	15.0(0.7)	5.4(4.0)	7.4(1.1)	4.1(2.0)
	UNL		All	59	2566	52	13.5(2.0)	5.2(1.9)	4.4(3.7)	1.5(1.8)
			First	3	3610	2	10.0(0.8)	1.7(0.7)	2.0(1.4)	1.0(0.0)
	CHEVY	PRO	Last	3	4527	3	14.2(3.2)	1.8(1.3)	4.3(2.9)	6.7(2.5)
			All	27	4362	23	15.2(3.5)	2.1(1.2)	3.4(2.6)	3.6(2.0)
	FORD	CNG	First	7	2704	2	10.4(0.1)	5.0(0.3)	4.0(4.2)	0.0(0.0)
			Last	7	3866	7	13.2(0.5)	6.0(3.3)	8.6(3.0)	1.6(0.5)
	UNL		All	57	3627	49	13.1(1.1)	5.4(1.4)	6.2(4.1)	1.0(0.8)
			First <sup>(e)</sup>	3	-	0	- (-)	- (-)	- (-)	- (-)
			Last	3	2644	3	13.4(0.3)	3.0(0.6)	6.3(3.8)	3.3(2.5)
			All	27	4197	24	14.4(1.4)	1.9(1.4)	3.9(3.5)	3.0(1.7)
Rialto	CHEVY	PRO	First	7	2572	6	11.5(1.4)	4.8(0.5)	6.2(3.2)	0.2(0.4)
			Last	7	4097	7	14.8(0.3)	5.0(2.3)	6.3(2.9)	4.1(2.2)
	FORD	PRO	All	59	3994	57	14.5(1.5)	4.4(1.3)	4.8(3.0)	1.8(2.2)
			First	3	4096	3	15.4(3.1)	2.2(0.7)	3.3(2.3)	5.7(4.0)
	UNL		Last	3	3170	3	17.5(4.0)	3.5(0.5)	7.7(3.8)	6.3(3.1)
			All	27	4209	27	18.9(3.2)	1.8(1.3)	4.3(2.6)	5.6(2.9)
	UNL		First	13	4445	13	10.1(1.1)	1.6(1.2)	8.2(4.1)	4.8(3.5)
			Last	13	3703	13	14.3(0.3)	2.9(1.4)	8.2(2.5)	7.2(2.7)
			All	118	4195	117	13.7(1.6)	3.0(1.3)	4.6(3.8)	4.1(2.8)
			First	3	6317	3	13.7(0.3)	0.3(0.5)	12.0(7.9)	7.3(0.6)
			Last	3	3299	3	14.5(0.7)	2.1(0.3)	4.0(2.6)	5.0(2.6)
			All	27	4586	27	14.9(1.3)	1.0(0.8)	4.5(4.1)	5.3(1.6)

## VEHICLE MAINTENANCE

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**Table D-3. Average and Standard Deviation (SD) of Measured Oil Properties at the First and Last Oil Changes and for All Oil Changes (Continued)**

Location	Vehicle Manufacturer	Fuel	Oil Change	Number of Oil Changes	Avg. Oil Miles <sup>(a)</sup>	Number of Oil Analyses	Viscosity Avg. (SD)	TBN Avg. (SD)	Oxidation Avg. (SD)	Nitration Avg. (SD)
Los Angeles	CHEVY	RFG	First	7	3478	6	11.8(1.5)	3.3(0.8)	1.2(0.8)	1.8(1.7)
			Last	7	2548	7	14.4(0.8)	3.5(1.1)	7.4(2.2)	3.0(0.8)
			All	55	2392	48	14.1(1.4)	3.9(1.2)	4.1(3.4)	1.7(1.5)
	DODGE	UNL	First	3	2976	2	11.2(2.7)	2.1(1.3)	1.5(2.1)	1.5(2.1)
			Last	3	1511	3	13.4(0.8)	4.0(1.2)	10.7(1.5)	2.7(1.2)
			All	23	2041	21	13.9(1.5)	3.3(0.9)	3.8(3.4)	1.8(1.3)
	FORD	RFG	First	7	2039	6	9.2(0.2)	3.9(1.6)	3.2(4.2)	0.3(0.5)
			Last	7	2030	7	13.9(0.8)	4.4(0.8)	8.1(2.5)	2.7(1.4)
			All	55	2330	48	13.5(1.9)	4.1(1.1)	3.9(3.2)	1.8(1.3)
	FORD	UNL	First	3	3522	3	10.2(0.6)	1.2(0.8)	5.3(3.8)	1.7(1.2)
			Last	3	2202	3	14.8(1.2)	2.6(0.7)	6.0(1.7)	3.7(2.1)
			All	25	3172	22	15.2(4.0)	2.6(1.2)	4.2(2.7)	2.8(2.0)
Santa Ana	FORD	M85	First	7	2446	6	10.3(1.5)	3.7(0.9)	5.2(4.1)	0.5(0.8)
			Last	7	2205	7	14.1(1.4)	3.8(1.1)	8.4(2.8)	3.3(1.4)
			All	57	2448	51	13.3(1.5)	4.0(0.8)	3.8(3.3)	1.4(1.3)
		UNL	First	3	1994	3	8.7(0.2)	3.0(0.6)	6.0(4.4)	0.7(0.6)
			Last	3	1970	3	12.8(0.8)	3.0(0.6)	10.7(1.5)	3.0(0.0)
			All	26	2198	24	12.2(1.7)	3.0(1.1)	4.3(3.5)	1.5(1.3)
ALL	CHEVY	UNL	First	20	1829	20	10.4(1.8)	5.3(1.4)	0.8(0.4)	1.7(2.5)
			Last	20	2925	20	11.3(0.5)	4.9(1.0)	1.4(1.0)	3.1(2.5)
			All	164	2845	162	11.0(1.0)	4.8(0.9)	0.6(0.7)	2.7(3.0)
	DODGE	UNL	First	3	3307	3	9.4(0.9)	2.6(0.2)	1.0(0.0)	1.7(2.1)
			Last	3	2527	3	13.4(0.8)	1.8(0.8)	10.7(1.5)	4.7(2.1)
			All	27	2717	27	12.9(1.5)	2.4(1.1)	3.7(3.3)	2.1(1.7)
	FORD	UNL	First	12	3873	9	10.6(2.4)	2.0(1.3)	6.3(6.6)	3.2(3.3)
			Last	12	2610	12	13.5(0.8)	2.5(0.8)	7.9(3.7)	4.0(2.0)
			All	107	3438	102	13.6(1.8)	2.1(1.3)	4.1(3.6)	3.0(2.1)

(a) Average miles between oil changes.  
 (b) Used in all vehicles except Ford M-85.

(c) No results were obtained. Oxidation and nitration were not measured in base oil.  
 (d) Used only in Ford M-85 vehicles.  
 (e) Oil samples were not collected.